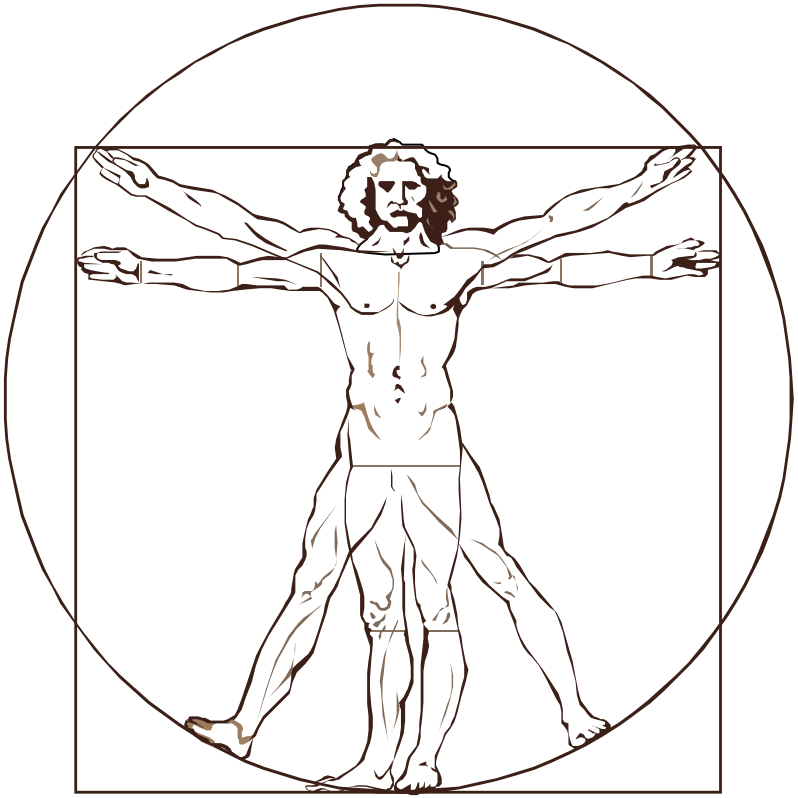
Human Factors Engineering



Michigan Safety Conference
April 17, 2013

Presented By:
Consultation Education & Training (CET) Division
Michigan Occupational Safety & Health Administration (MIOSHA)
Michigan Department of Licensing and Regulatory Affairs
www.michigan.gov/miosha
(517) 322-1809

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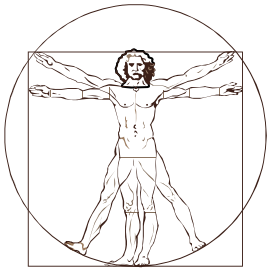
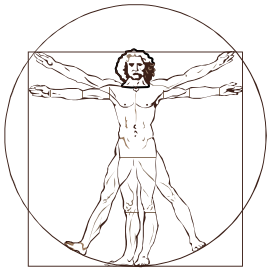
MIOSHA
Michigan Occupational Safety and Health Administration



Human Factors Engineering…

ERGONOMICS!



Why is Ergonomics Important?

To prevent the development of Work Related Musculoskeletal Disorders (WMSDs):

- Disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, and spinal discs.
- Result of chronic overuse of body parts.
- Approximately 400,000 cases each year.
- Direct costs per case can range from thousands to tens of thousands of dollars.
- Also results in loss of productivity, personal pain and suffering, and worker dissatisfaction.

THE HIDDEN COSTS OF INJURIES

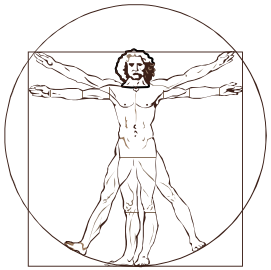
DIRECT COST

- Compensation Payments
- Medical Cost

INDIRECT AND HIDDEN COSTS OF INJURIES

- Replacing Employees
- Investigation Time
- Supervision Time
- Training
- Staff Moral
- Possible Patient Injury
- Break-up Work Team
- Administrative Time
- Overtime Paid
- All Other Costs

For every $1 in Direct Costs, there is approximately $4 in Indirect Costs

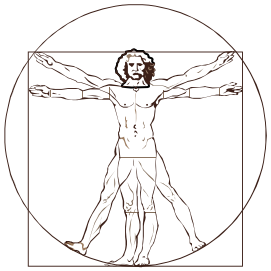


Causes of Disabling Occupational Injury

From the 2012 Liberty Mutual Workplace Safety Index…

- Number 1: Overexertion (due to excessive lifting, pushing, pulling, holding, carrying, and throwing):
  - $13.61 billion in direct costs in 2010.
  - Represented more than 25% of the national cost burden.
- Number 7: Repetitive motion injuries (due to repeated stress or strain)
  - $2.02 billion in direct costs in 2010.
  - Represented 4% of the national cost burden.
- On a positive note, from 1998 to 2010*:
  - Overexertion injury direct costs have decreased by 5.7%!
  - Repetitive motion injuries direct costs have decreased by 39.7%!

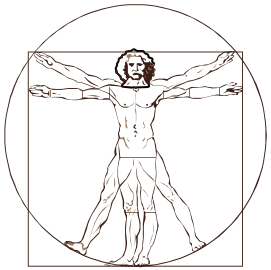
* Inflation-adjusted



Causes of Disabling Occupational Injury – cont.

MIOSHA – Michigan Occupational Injury and Illness Case Demographic Data 2011.

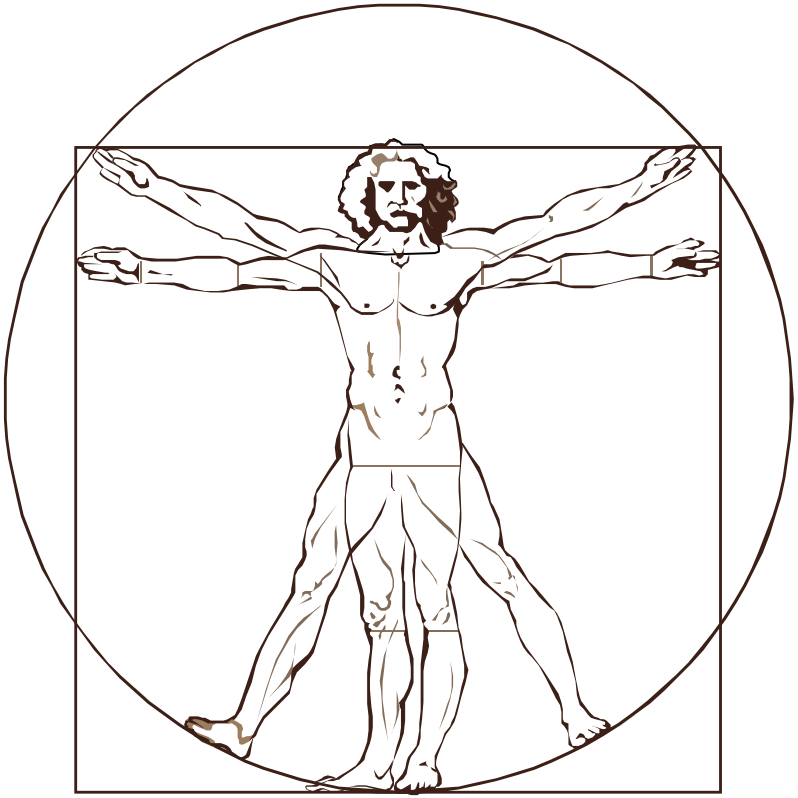
Overexertion injuries accounted for one–third of all occupational non-fatal injuries in 2011.

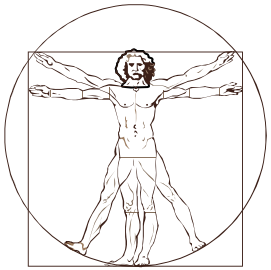


Objectives of this session…

- Identify risk factors that contribute to ergonomic injury and illness in the workplace.
- Discuss elements of a successful ergonomics program.
- Discuss the MIOSHA Ergonomics Instruction.

Risk Factors for Developing WMSDs





Occupational Risk Factors

Primary Factors:

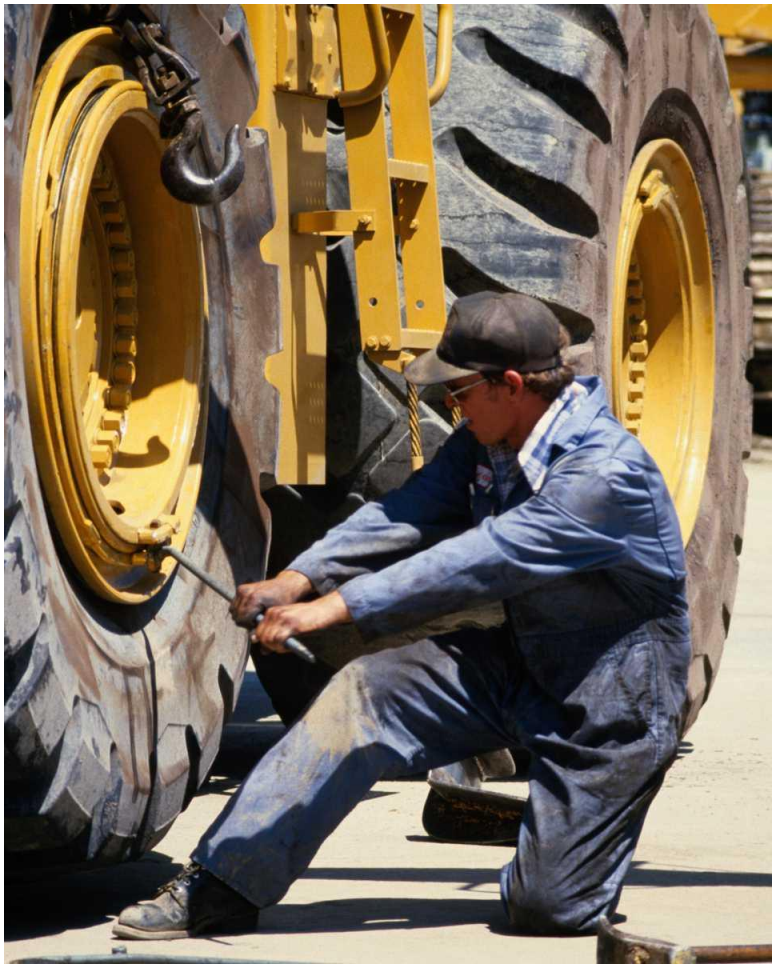
- Forceful exertion
- Awkward posture
- Repetitive motions

Other Factors:

- Duration
- Mechanical compression
- Static postures
- Vibration
  - Whole body
  - Localized or segmental
- Temperature

Forceful Exertions

- Lifting
- Pulling
- Pushing
- Small muscles applying great force (e.g., pinch grip)
- Fatigue, wear and tear on muscles, ligaments, spinal discs



Forceful Exertions Example

Awkward Postures

- Bending
- Twisting
- Squatting
- Kneeling
- Hands over head
- Frequency, duration, use of force while in the awkward position

Awkward Postures Example

Repetitive Motions

- Occur every few seconds for an 8-hour shift
- Lack of recovery time
- Increased ergonomic stress in conjunction with force and posture

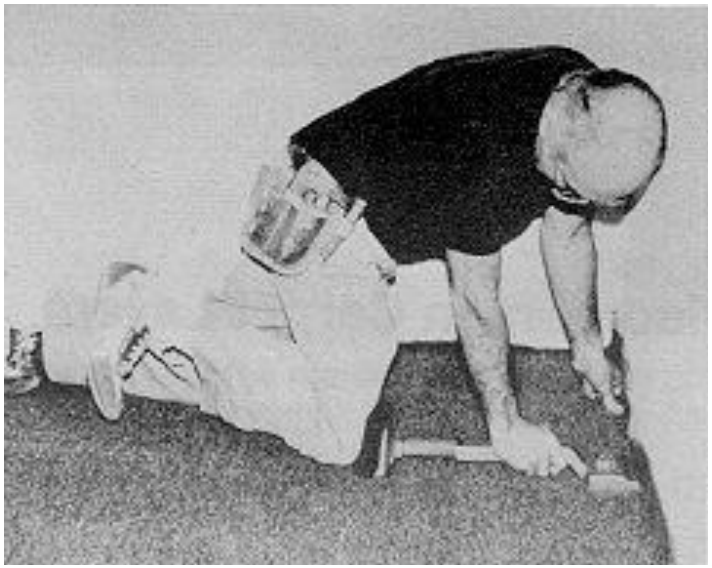
Repetitive Motions Example

Duration

- Amount of time a person is continually exposed to one or more risk factor(s).
- Recovery period.
- In general, the longer the duration of continuous work, the longer the rest or recovery period needed.

Mechanical Compression

- Occurs due to contact stresses
- Repeated or continuous contact with sharp objects
  - Use of body part as a hammer
  - Leaning or pressing up against
- Causes impairment of nerve function and blood circulation



Static Postures

- Muscles perform both dynamic and static work
- Full force at >10 seconds leads to fatigue

Vibration

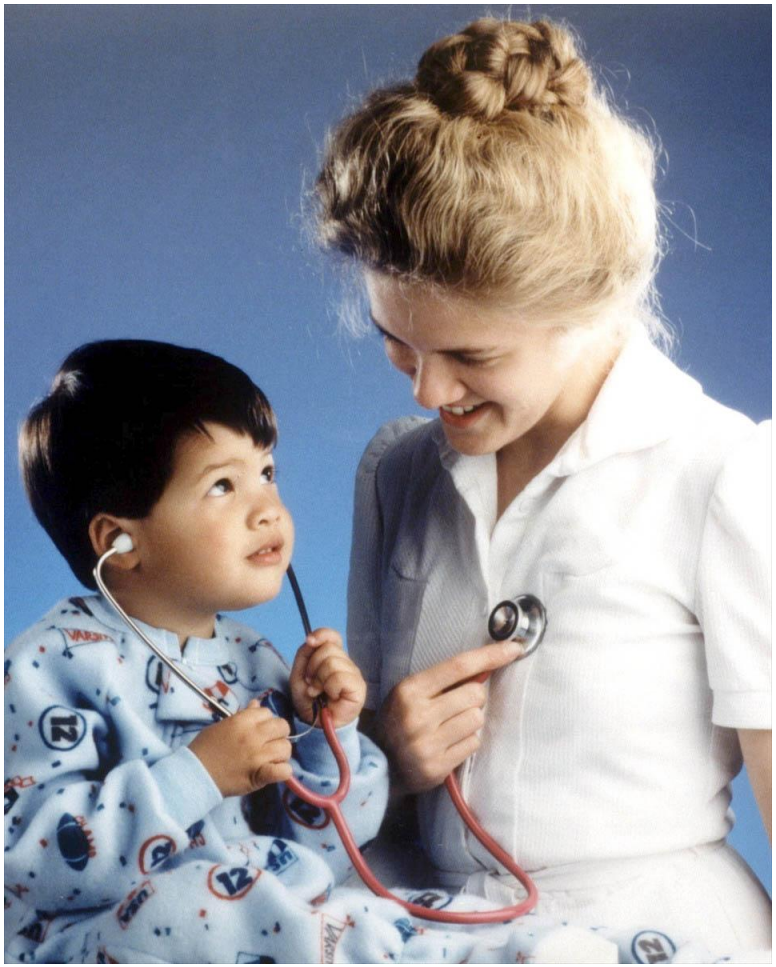
- Whole body or localized contact with vibrating tools, machines, or vehicles
- Impairs/disrupts nerve function and blood flow

Other Ergonomic Considerations

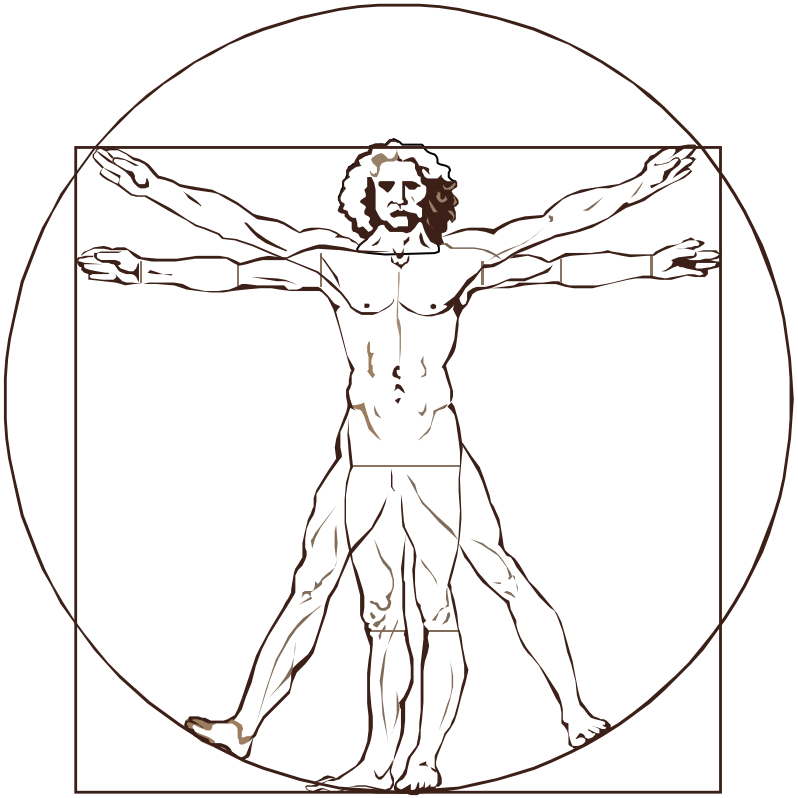
- Temperature:
  - Decreased blood flow to muscles
  - Commonly a result of cold air exhaust from pneumatic tools discharging on the body
- Unfamiliar or unaccustomed work
- Individual risk factors…

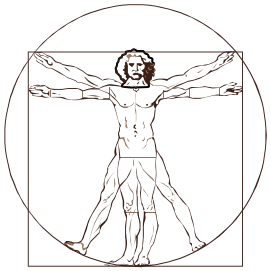
Individual Risk Factors Associated with WMSDs

- Age
- Gender
- Smoking
- Physical activity
- Strength
- Anthropometry



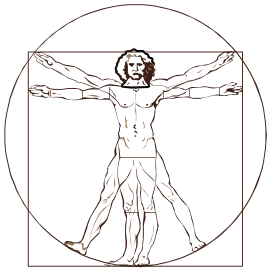
Developing an Ergonomics Program





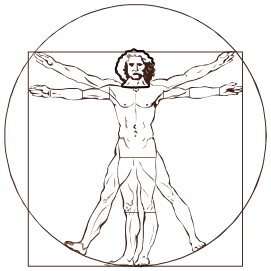
Ideal Outcomes of an Effective Ergonomics Program

- Gains management support and commitment.
- Identifies risk factors present in the workplace.
- Develops and implements appropriate, feasible and effective controls:
  - Engineering
  - Work practices and administrative
  - Medical management
- Provides training for employees and other appropriate parties.
- Results in a financial benefit to the company.



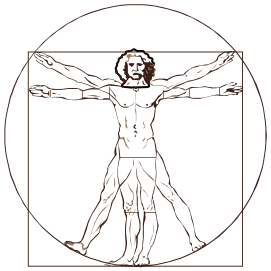
Washington State Department of Labor and Industries

- http://www.lni.wa.gov/Safety/Topics/Ergonomics/default.asp
- An excellent resource for learning about ergonomics
- Provides information regarding ergonomic:
  - Success stories
  - Demonstration projects
  - Awards
  - Case studies



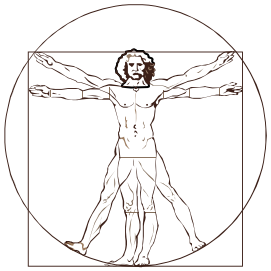
Elements of an Effective Ergonomics Program

- Management Leadership
- Employee Participation
- Workplace Analysis
- Records Analysis
- Hazard Prevention and Control
- Medical Management
- Training



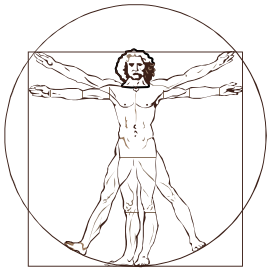
Management Leadership

- Demonstrate commitment to reduce or eliminate ergonomic hazards.
- Develop written program:
  - Continued training of employees in injury prevention.
  - Implement methods of employee protection.
  - Implement early reporting procedures.



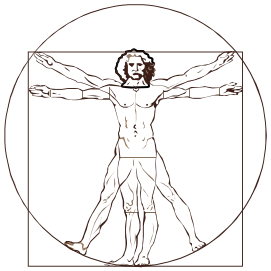
Employee Participation

- Complaint/suggestion program which includes employee reports of unsafe working conditions.
- Prompt reporting of signs and symptoms as well as injuries.
- Involvement in:
  - Establishment and running of the program.
  - Resolving identified hazards.



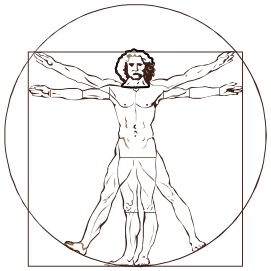
Workplace Analysis

- Identify existing and potential workplace hazards.
- Assessment of exposure to ergonomic stressors and risk of pain or injury:
  - Duration (i.e., recovery period)
  - Frequency (i.e., repetition)
  - Magnitude:
    - Force
    - Awkward and static postures
    - Vibration
    - Contact stress



Workplace Analysis Tools

- Observation
- Workplace walkthroughs
- Talking with employees
- Periodic screening surveys
- Records reviews

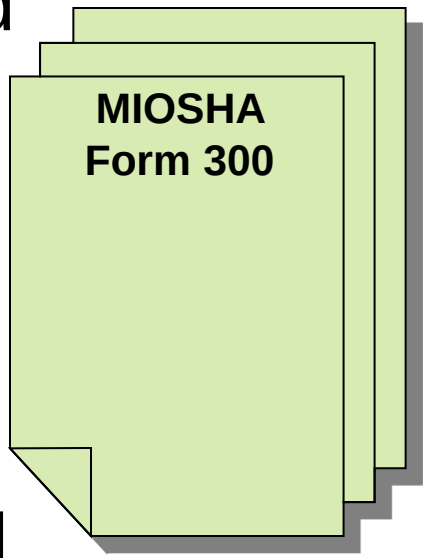


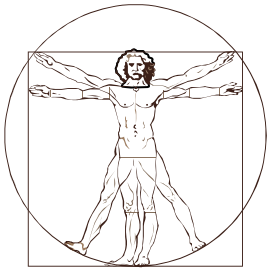
Available Ergonomic Task Analysis Tools

- Rapid Upper Limb Assessment (RULA)
- Rapid Entire Body Assessment (REBA)
- GM-UAW Risk Factor Checklist
- ACGIH Hand/Arm (Segmental) Vibration TLV
- Job Strain Index
- Revised NIOSH Lifting Equation
- Snook Push/Pull Hazard Tables
- State of Washington Hazard and Caution Zone Checklists
- Others – search the Internet

Records Analysis

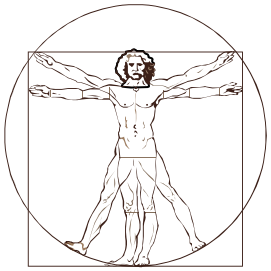
- Analyze records of injuries and illnesses:
  - Identify trends/patterns that occur over time.
  - Enable hazards to be addressed and prevented.
- This includes reviewing:
  - MIOSHA 300 logs and 300A forms,
  - MIOSHA 301 forms,
  - Workers' Compensation reports, and
  - Other records as necessary.





Calculating Incidence Rates

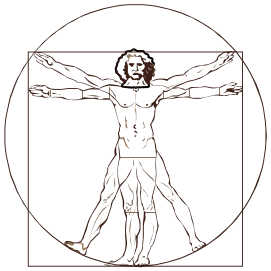
- Types of Incidence Rates:
  - Days away and restricted time (DART) rate
  - Total case incidence rate (TCIR)
  - Ergonomic case incidence rate
- Sites for TCIR and DART rates for comparison against company rates:
  - MIOSHA (“incidence rate by industry” reports): http://www.michigan.gov/dleg/0,1607,7-154-11407_30929-39936--,00.html
  - OSHA (“summary tables” then “incidence rates – detailed industry level” reports): http://www.bls.gov/iif/oshsum.htm



Ergonomic Incidence Rates

Information to obtain:

- Number of ergonomic cases:
  - Similarly exposed workgroups (SEGs)
  - Avoid strain/sprain cases not caused by ergonomic stressors (e.g., strain caused by a slip or trip)
- Total number of employee-hours worked by SEG employees:
  - Usually not the hours worked by all employees
  - May estimate by determining the number of employees in the SEG and multiplying by 2,000 hours worked per year

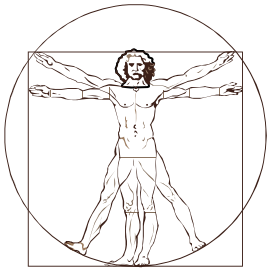


Calculating an Ergonomic Incidence Rate

- Ergo IR (actual) $= \dfrac{(\#\text{ of Ergo Cases in SEG}) \times 200{,}000}{(\#\text{ of Employees-hours Worked by SEG})}$

Ergo IR (estimate) $= \dfrac{(\#\text{ of Ergo Cases in SEG}) \times 100}{(\#\text{ of Employees in SEG})}$

- Where Ergo IR = ergonomic incidence rate
- 200,000 = 100 employees working 40 hours per week for 50 weeks per year (or 2,000 hours/year)

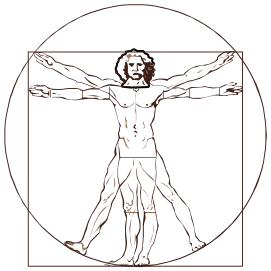


Sample Problem: Estimated Ergonomic Incidence Rate

- A company of 100 people has 15 employees who load boxes of product onto a pallet for shipment. Pallets are located on the floor. Boxes of product weighing 50 pounds each are fed to employees by a conveyor system. Three low back injury and two strain cases have been reported by this group. What is the estimated ergonomic incidence rate?
- Ergo IR = (5 cases/15 SEG employees) x 100

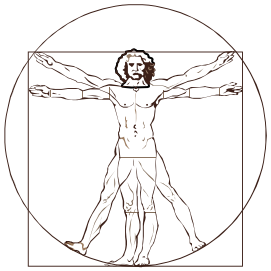
  = 0.33 x 100 = 33%

  Result: "disproportionate number" of employees in a similar job with WMSDs



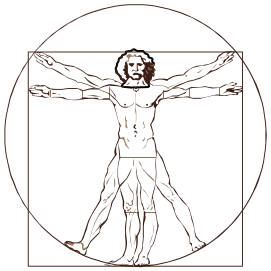
Medical Management

- Implement a medical management program.
  - Manage care injured employees.
  - Supervised by a person trained in WMSD prevention.
  - Re-evaluate temporary restriction on a regular basis.
- The program should ensure:
  - Early identification and treatment of injured employees.
  - Accurate injury and illness recordkeeping.
  - “Light duty” or “no lifting” work restrictions during recovery periods.
  - Systematic evaluation and referral of injured employees.



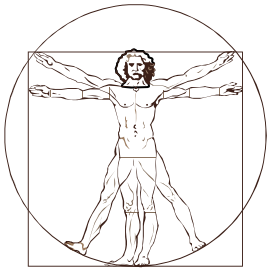
Training

- Implement ergonomics training program:
  - Designed and implemented by qualified persons.
  - Updated and provided to employees as changes occur at the workplace.
  - Provided at a level of understanding appropriate for those individuals being trained.
- New employee orientation
- Recurrent education and training on ergonomic hazards and controls for:
  - Managers and supervisors
  - Healthcare providers
  - Employees



Training Program Elements

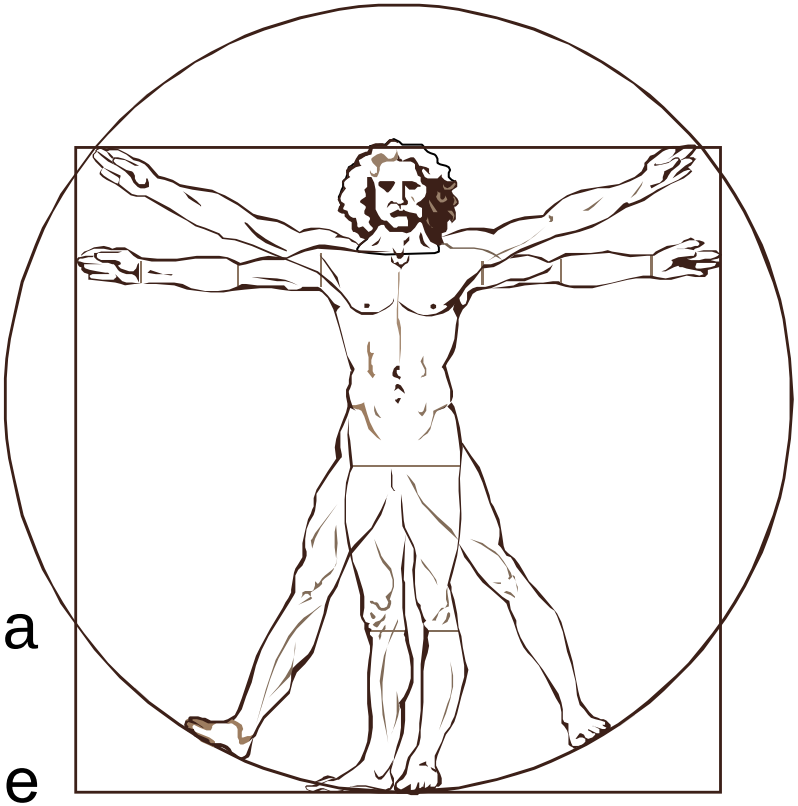
- Ability to ask questions of the trainer.
- Overview of potential risks, causes, stressors, and symptoms of ergonomic injuries.
- Methods of controlling ergonomic hazards:
  - Engineering controls
  - Administrative controls
  - Work practice controls



Training Program Elements – continued

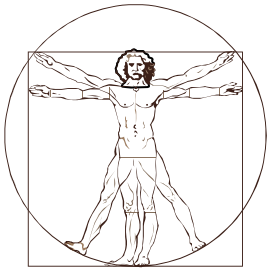
- Recognition of signs and symptoms of WMSDs.
- Procedures for reporting potential problems.
- Encouragement of physical wellness and fitness.
- Lifting guidelines.

MIOSHA Ergonomics Instruction



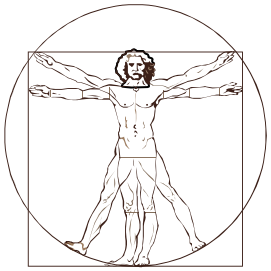
To obtain the instruction:

- Go to www.michigan/gov/miosha
- Select the "**Policies and Procedures**" hyperlink along the left side of the page
- Select the "**Search Instructions**" hyperlink
- Type "**ergonomics**" in the field to the right of **Word or Title** and then select "**Search**"



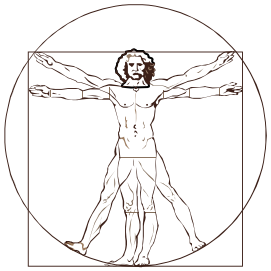
MIOSHA Ergonomics Instruction, GISHD-GEN-05-1R1

- Policy and procedures for conducting inspections of ergonomic hazards.
- Establishes guidance as to when an ergonomic “hazard” exists.
- Provides checklists used during ergonomic inspections.



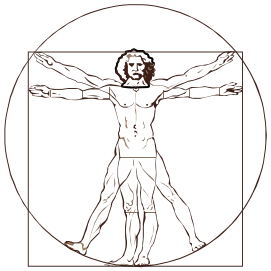
Citations for Ergonomic Hazards in the Workplace

- General Duty Clause (GDC): Section 11(a) of Michigan P.A. 154 of 1974.
- Four elements must exist to prove a violation of the GDC:
  - A hazard exists. (objective data from medical records)
  - The hazard can cause serious physical harm. (establish risk factors to health outcomes)
  - The hazard was recognized. (employer knowledge)
  - A feasible means of abatement exists.



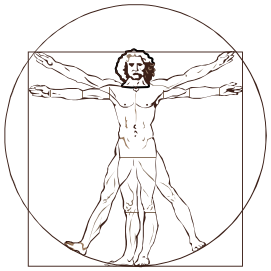
The instruction addresses…

- Injury and illness data review (three years): Form 300, Form 300A, Form 301 (or similar), and additional medical records as necessary.
- Conduct of the inspection.
- Selection of positions/workstations for investigation.
- Evaluation (ergonomic incidence rate calculation)
- Job cycle sheet and workstation sketch.
- Checklists: risk factors, energy expenditure, environmental, posture, manual lifting, and upper extremity.



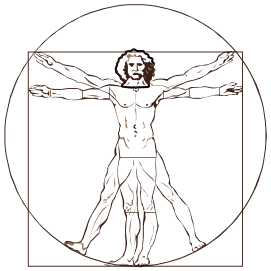
Summary

- Identify risk factors that contribute to ergonomic injury and illness in the workplace.
- Discuss elements of a successful ergonomics program.
- Discuss the MIOSHA Ergonomics Instruction.



Resources

- MIOSHA/OSHA
- National Institute for Occupational Safety and Health (NIOSH)
- Insurance carrier
- Local safety council
- Industry groups/associations
- Healthcare provider
- Consultants
- Material handling, office supply, and other equipment manufacturers
- In-house resources
- Various publications
- Additional resource list in appendix



Questions?